

Laparoscopic Hysterectomy of Large Uteri With Uterine Artery Coagulation at Its Origin

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ABSTRACT

Background: To argue the usefulness for performing total laparoscopic hysterectomy with primary uterine artery coagulation at its origin for a series of women presenting with an enlarged benign uterus.

Method: Eighteen women having undergone the procedure consecutively during a period of 17 months were studied retrospectively. The inclusion criteria were an enlarged benign uterus weighing more than 280 g, managed by total laparoscopic hysterectomy with primary uterine artery coagulation at its origin.

Results: Patient median values (range) for age, body mass index, and parity were respectively 47.5 years (range, 38 to 53), 25 kg/m² (range, 19.3 to 34.9), and 2 (range, 0 to 3). The median value for uterine weight (range) was 540 g (range, 280 to 1,015), and the median duration for the surgical procedure was 185 minutes (range, 90 to 260), the longest procedures being due to associated deep endometriosis resection and extensive adhesions. The duration of the intervention was not significantly correlated with uterine size (correlation coefficient $r = -0.15$, $P = 0.56$), and no intra- or postoperative complications were recorded.

Conclusion: The selective coagulation of the uterine artery at its origin is a reproducible technique that allows total laparoscopic hysterectomy in enlarged uteri. This procedure avoids unexpected intraoperative hemorrhage requiring conversion to the abdominal route and provides optimal protection for the ureter.

Key Words: Laparoscopic hysterectomy, Total hysterectomy, Uterine artery, Umbilical artery.

INTRODUCTION

Hysterectomy remains the most common major gynecological operation and may be carried out by 3 different routes: vaginal, abdominal, and laparoscopic. Clearly, indications for these 3 routes should differ, but they can also overlap. Although the abdominal route is unanimously considered the most morbid hysterectomy procedure, the vaginal route appears to be the quickest and the least expensive when it can be safely conducted.¹ However, with increases in uterine weight the vaginal route becomes more difficult, especially in nulliparas, and in these patients, the laparoscopic route may allow for a laparotomy to be avoided. Nevertheless, it should be noted that in more than 1,000 publications on laparoscopic hysterectomy, opinion concerning its role is greatly divided.

Although many enlarged uteri can be delivered vaginally by skilled surgeons, the procedure is not always quick and safe.²⁻⁵ In patients with enlarged uteri, blood loss may be considerable, especially when extended time is required to morcellate the uterus, leading to unavoidable retrograde bleeding.⁶ Laparoscopic hysterectomy can be a valid surgical approach in these cases,^{7,8} though it may be useful to modify several stages of the classical procedure to make it safer.^{6,9,10} The laparoscopic approach allows the interruption of blood supply before uterine procedures and the beginning of uterine morcellation. The aim of our study was to describe the total laparoscopic hysterectomy technique using primary uterine devascularization and to report outcomes for a series of women with enlarged uteri benign pathology who benefited from this procedure.

METHODS

Technique Description

Total laparoscopic hysterectomy is preceded by a 7-day free-residue diet, to diminish intraabdominal volume taken up by intestinal loops. In cases where uterus weight is estimated at more than 800 g to 1,000 g (range, 1.8 to 2.2 lb), an injection of 11.75 mg leuprolerin LP is administered 3 months before surgery, with the aim of reducing both uterine volume and vascularization.^{11,12}

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The keys to a successful procedure are the upward trocar sites that depend solely on uterine size, the complete devascularization of the uterus before any other surgical procedure is performed on the uterus, and its appropriate fragmentation which allows sectioning of the uterine pedicles close to the uterus, bladder dissection, and decreases both the duration and difficulty of the vaginal stage. To these could be added the previous free-residue diet that further guarantees safety and intraoperative convenience and the strong mobilization of the uterus by use of a uterine manipulator.

The patient is placed in the dorsal recumbent position. The Clermont Ferrand type uterine manipulator, commercialized by Karl Storz GmbH & Co (Tuttlingen, Germany), is used to allow lateral mobilization of the uterus by a third surgeon positioned between the patient's legs. In most cases, 2 ancillary 12-mm trocars are placed on the umbilicus and 8 cm above and 2 ancillary 5-mm trocars are placed on the 2 sides of the umbilicus, at 8 cm to 10 cm laterally. The position of the trocars may vary depending on uterine size.

The first stage, performed at the onset of the surgical procedure, is complete uterus devascularization, by coagulating both uterine arteries at the artery origin and infundibulo-pelvic ligaments or utero-ovarian vessels. The second operator grasps and tracks the umbilical artery upwards, and the third operator carries out uterine contralateral mobilization. The round ligament is coagulated and transected. The peritoneum is opened on the anterior leaf of the broad ligament, parallel to the infundibulo-pelvic ligament, along the umbilical artery and above the crossing with the external iliac artery. The superior bladder artery is crossed, and care should be taken to avoid confusion with the uterine artery, which is situated 1 cm to 2 cm further back. The uterine artery origin is then revealed and the pararectal space opened making the ureter easy to identify. The uterine artery is coagulated, using bipolar current, at its origin from the internal iliac artery (**Figure 1**), while the ureter is carefully pushed medially to avoid electrical injury. The artery is not generally sectioned to prevent bleeding. Devascularization is accomplished by the coagulation and section of either ovarian (if adnexectomy is performed) or utero-ovarian vessels. The uterus becomes notably ischemic and undergoes a marked color change.

The next stage of the laparoscopic hysterectomy involves reducing the volume of the uterus either by uterine bisection or multiple myomectomies, using a laparoscopic cold knife, a monopolar current hook (40 W) or a Harmonic scalpel (Ethicon Endo Surgery, Issy-le-Moulineaux,

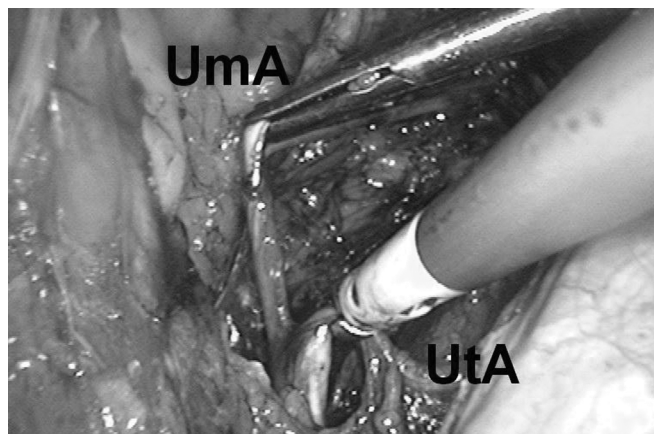


Figure 1. The left uterine artery is coagulated at its origin with bipolar current (UtA – left uterine artery; UmA – left umbilical artery).

France). This stage does not require coagulation, as only venous blood retained in the uterus is lost. However, this procedure may take 40 minutes to 60 minutes in cases where morcellating the uterus is impeded by hard myomas or adenomyosis.

The following stages are similar to those described in the classical procedure.⁷ Uterosacral ligaments are coagulated and sectioned, increasing uterine mobility. The bladder flap is opened using bipolar coagulation forceps, scissors, or a Harmonic scalpel. Uterine pedicles are coagulated and safely sectioned close to the uterine isthmus. The vagina is opened laparoscopically using a monopolar current hook or a Harmonic scalpel. The patient's position is altered to allow for the retrieval of uterine fragments using the vaginal approach, the procedure taking up to 30 minutes to 40 minutes, depending on the efficiency of the laparoscopic uterine fragmentation. The vagina is then sutured and lastly hemostasis is checked by laparoscopy.

Patients

Women who underwent a laparoscopic hysterectomy performed with the technique described above, between December 26, 2005 and March 7, 2007 in our department, and who had a uterus weighing more than 280 g, were retrospectively included in the study. The 280 g cutoff corresponds to the superior limit recommended by the American College of Obstetricians and Gynecologists (ACOG) for the vaginal route (approximately 12-weeks' gestational size or 280 g).^{2,4,5}

The following patient characteristics were provided by medical chart: age, weight, height, body mass index

(BMI), parity, delivery route (vaginal or cesarean), pelvic surgical antecedents, menopausal status, hormonal substitutive treatment, reasons for the hysterectomy, the duration of the procedure, the volume of CO₂ insufflated, other surgical gestures associated with the hysterectomy and uterus weight, histological examination results, duration of the hospitalization, and postoperative complications. In accordance with French law, this retrospective study was exempt from IRB approval.

Continuous variables are expressed as mean \pm SD, median (quartiles and range), and qualitative variables as number (percentages). The relationship between uterine weight and duration of the surgical procedure was estimated using the correlation coefficient *r*.

RESULTS

See **Table 1**. During the study period, the procedure described above was used in more than 50 women with benign uterine pathologies, rectovaginal and rectal endometriosis, endometrial cancer, or pelvic inflammatory diseases. Of them, 18 women meeting the selection criteria were included in the study.

One woman was postmenopausal, with no hormonal substitution, and 2 patients had previously had cesarean deliveries (11%). The patients' complaints were abnormal bleeding in 13 cases (72%), pelvic pain in 8 cases (44%), and bladder and bowel symptoms due to increased uterine volume in 4 cases (22%).

The duration of the surgical procedure ranged from 90 minutes to 260 minutes (median, 185), and the duration of the devascularization procedure (involving identification of the umbilical ligament, coagulation of the uterine artery and coagulation of either the ovarian or utero-ovarian artery) averaged 10 minutes per side (range, 5 to 20). Bilateral oophorectomy was carried out in 7 cases (39%). The 3 longest operative times were due to additional procedures: resection of deep posterior endometriosis in 2 cases (11%) and extensive adhesiolysis in 1 case (6%). The correlation coefficient *r* was -0.15 (*P*=0.56) (**Figure 2**), showing that the duration of the intervention was not related to uterine size, but mainly due to the necessity to perform associated procedures and to the duration of the uterine fragmentation stage.

Histopathologic analysis revealed myomas in 15 cases (83%) and adenomyosis in 3 patients (17%). No intraoperative complications (bleeding, digestive, or urinary injuries) or major approach difficulties were noted. The outcomes were favorable with no postoperative complications.

Women participating in the study were managed by 4 surgeons, one who (HR) generally carries out laparoscopic hysterectomies and 3 others (LM, BR, EL) who usually perform vaginal hysterectomies even in uteri exceeding 280 g. Throughout the study period, only 2 women meeting the inclusion criteria had abdominal hysterectomies performed by the same surgeon (BR), justified respectively by the size of the uterus (more than 2300 g)

Table 1.
Patient Characteristics and Data Related to Surgical Procedure and Outcomes (N = 18)

Parameters	Mean \pm SD	Median	Percentiles 25 th , 75 th	Range
Age (years)	46.6 \pm 4.4	47.5	43, 51	38–53
Body Mass Index (kg/m ²)	25.4 \pm 4.3	25	22.3, 27.9	19.3–34.9
Parity	1.8 \pm 0.8	2	1, 2	0–3
Surgical Procedure Length (min)				
Laparoscopic stage	154 \pm 41	140	130, 180	80–245
Vaginal stage	32 \pm 20	30	15, 45	5–70
Total	186 \pm 47	185	155, 230	90–260
Volume of CO ₂ Insufflated (L)	280 \pm 131	300	185, 354	75–575
Uterine Weight (g)	575 \pm 218	540	370, 776	280–1015
Difference of Hemoglobin Concentration (preoperative value vs. day 1 value, g%)	1.5 \pm 1	1.3	0.6, 2.2	0.1–3.5
Length of Hospitalization (days)	3.1 \pm 0.9	3	3, 3	2–5

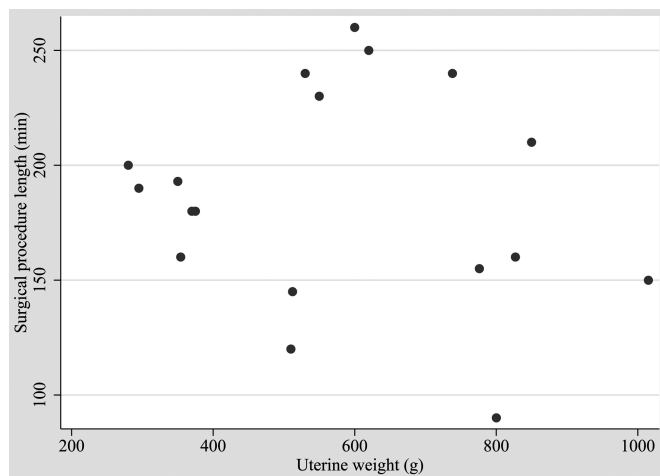


Figure 2. Correlation between uterine weight and length of surgical procedure (N=18, correlation coefficient $r=-0.15$, $P=0.56$).

and extended deep endometriosis in a woman with a 510 g uterus. All surgeons found that the technique was useful, reproducible, and safe.

DISCUSSION

This technique is feasible and reproducible by gynecological surgeons and avoids the use of laparotomy in enlarged uteri. In our department, one surgeon began using the technique, and subsequently it was acquired and easily reproduced by others. Approaching the origin of the uterine artery is possible despite uterine size and is feasible for surgeons skilled in pelvic lymph node dissection. In our opinion, the key to a successful procedure is the performance of uterine devascularization before initiating further uterine surgical actions. An obvious color change of the uterus indicates that the classical procedure of laparoscopic or vaginal hysterectomy can then be safely begun. This technique also includes opening of the pararectal space and allows separation of the ureter from the uterine artery, enabling coagulation to be safely accomplished under direct visual control. From this stage onwards, the ureter may be easily located without difficulty thus preventing ureter damage. Although surgeons may prefer the vaginal route, the primary laparoscopic coagulation of the uterine artery at the artery origin allows for a safer vaginal hysterectomy when the uterus is particularly enlarged.

In our study, the median procedure time was 185 minutes, with longer operating times in women with associated pelvic pathologies like endometriosis. Longer operative times also occurred in cases of large uteri due to adenomyosis, which

impeded fragmentation. Uterine fragmentation represented the longest stage of this procedure, and research is being pursued to find ways of making this both quicker and easier, with the possible use of morcellators. The duration of the procedure in our series is comparable to those of several authors who have reported total laparoscopic hysterectomies in enlarged uteri,^{8,10} but is longer than that of Kohler et al⁶ who exclusively carry out vaginal morcellation.

Major difficulties could be encountered related to morbid obesity and extensive intraabdominal adhesions.¹³ It should be noted that our rate of obese women is low. During the research period, hysterectomies were not performed in morbidly obese women meeting inclusion criteria, but high BMI can increase both procedure duration and intraoperative difficulties.¹³ Similarly, in one case where extensive adhesiolysis was required, the operative time increased to 250 minutes. Adhesions are a well-known risk factor for complications and conversion to the abdominal route¹⁴ and particular care is needed in these situations.

Abdominal hysterectomy was carried out in one woman whose uterus weighed 2300 g. Although devascularization can be performed in very enlarged uteri by using two 12-mm trocars in both the right and left upper quadrants,¹⁵ the fragmentation and retrieval of the uterus by the above described technique would be excessively long and challenging.

With regard to patient inclusion criteria, a uterus weight cutoff was chosen of 280 g as vaginal hysterectomy appears to be the fastest, cheapest, and least morbid surgical route in small and moderately large uteri.² We are in agreement with several studies^{13,16,17} that show that the laparoscopic route does not provide a significant benefit in uteri weighing less than 280 g representing the majority of cases in daily practice. This cutoff is higher for surgeons skilled in the vaginal route who are able to remove the majority of uteri transvaginally regardless of size. However, in uteri weighing more than 500 g to 600 g, the vaginal route presents difficulties particularly amongst nulliparas.⁹

Although laparoscopic hysterectomy has now existed for 18 years, its place has not yet been established, and it is routinely carried out by a small number of gynecological surgeons.¹⁴ This situation may be the result of controversial discussions between defenders of either the vaginal or laparoscopic route in hysterectomy, who have tended to point out the weaknesses of the other approach rather than focusing on specific indications for their own technique. In addition, most surgeons are not trained in both techniques¹⁸ and are likely to defend the approach that they master the best.

As a conclusion to their systematic review, Johnston et al¹⁹ stated that no evidence supports the use of laparoscopic hysterectomy as opposed to vaginal hysterectomy if the latter can be done safely.¹⁹ This statement in our opinion is not unfavorable to the laparoscopic procedure, as surgeons can choose to either carry out a vaginal hysterectomy where they feel it is feasible or to perform the laparoscopic route in other cases. In these "other cases," the above-described technique is useful as it may protect against unexpected intraoperative hemorrhage requiring conversion to the abdominal route, and it provides optimal protection for the ureter. However, to be able to carry out a laparoscopic hysterectomy in enlarged uteri, surgeons should previously perform this procedure in small uteri, namely in uteri where vaginal delivery appears to be the best choice. Surgeons should be aware that performing vaginal hysterectomy whenever it can be done safely must not lead to inadequate training in laparoscopic hysterectomy.

CONCLUSION

The selective coagulation of the uterine artery at its origin is a reproducible technique that allows safe total laparoscopic hysterectomy in enlarged uteri. This procedure avoids unexpected perioperative hemorrhage requiring conversion to the abdominal route and provides optimal protection for the ureter.

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